Overview of Riparian Restoration in the Southwest

David R. Dreesen, Ph.D. *– USDA-NRCS New Mexico Plant Materials Center*

Wildlife biologists and plant scientists have long recognized the value of riparian vegetation for the diversity of plant and animal life present in desert oases of the Southwest. However, the protection and proper management of these highly prized resources has become a primary mission for public and private land managers only in the last several decades. Multi-disciplinary studies of riparian ecosystems in the Southwest (such as Prichard and others, 1998) have shown that properly functioning riparian zones can provide many benefits to watersheds, including:

- Reducing erosion of sediments and improving water quality by lessening the impact of flood events.
- Aiding in the development of floodplains by filtering and capturing sediments.
- Assisting the retention of floodwaters, reducing maximum flows and recharging shallow alluvial aquifers.
- Resisting the cutting force of flowing water by root masses of riparian vegetation stabilizing stream banks.
- Providing rare and diverse terrestrial and aquatic wildlife habitats that result from the formation of assorted channels and ponds.

An array of natural and human-generated processes can degrade the proper functioning condition of Southwest riparian areas. These disturbances affect riparian systems from the subalpine headwaters to the forested floodplain riparian areas ("bosques") along rivers flowing through desert regions.

A Range of Disturbances

At lower elevations, agricultural irrigation and flood control have imposed structures and water management regimes that have disrupted the natural regeneration of cottonwood bosques. River flow management has created man-made hydrographs and prevented or limited natural flood events that have altered sediment deposition and hydrologic conditions required for the regeneration and maintenance of cottonwood bosques. Flood control levees have constrained the extent of the floodplain and restricted the natural meanders of these river systems. Riverbeds have been channelized to reduce flooding and increase water transport efficiency, in effect forming man-made water conveyance systems. Drainage of agricultural lands has altered shallow alluvial aquifers that had previously supported riparian-wetland plant communities.

The loss of natural regeneration of cottonwoods and willows and the increased salinity of floodplain soils have aided the invasion of exotic woody species including saltcedar and Russian olive. The elimination of flooding which severely reduces the decomposition of woody debris, together with the fuel loads produced by noxious woody invaders, has created degraded riparian areas very susceptible to catastrophic wildfire.

At higher elevations in forest environments, catastrophic wildfires can result in massive erosion and sediment deposition in riparian areas, destroying fish and wildlife habitat, recreational facilities, and municipal water supplies. Poor management of domestic and wild herbivores can result in decimated vegetation that perturbs proper function of riparian systems. Watersheds suffering from long-term overgrazing are more susceptible to extreme flood events resulting in accelerated rates of channel lowering. Poorly designed and utilized logging roads and skid trails as well as inadequate buffer zones bordering streams have contributed to the degradation of montane riparian plant communities. Roads and recreational facilities in forested areas are typically situated in canyon bottoms with the resulting degradation of stream courses and surrounding riparian areas.

Restoring Compromised Riparian Zones

Some restoration approaches rely on landscape-scale management. For instance, overgrazing by elk and cattle can be addressed by fenced exclosures of degraded riparian areas or by reducing wild animal numbers through hunting and predation, management of cattle herd size, and timing of utilization. The devastation of catastrophic wildfires can be reduced by allowing natural or prescribed burns to reduce fuel loads and tree density, introducing fuel breaks, and restoring heterogeneous plant communities to forested landscapes.

In natural stream systems, manipulating channels to re-establish the appropriate sinuosity, width/depth ratios, and gradients have restored proper function or counteracted processes degrading riparian zones (Rosgen, 1996). Bioengineering approaches have restored critical areas experiencing severe erosion, provided that these methods have been applied in accord with the hydrology and morphology of the particular stream reach. Such applications include brush matting or brush mattresses, brush layering, fascines or wattles, and root wads (Bentrup and Hoag, 1998).

Some natural regeneration of riparian areas is conceptually feasible for human-altered river systems. By storing snowmelt in reservoirs during times of higher than normal precipitation, such as El Niño periods, water releases can be timed to simulate natural spring floods for several successive years. Assuming that invasive exotics have been removed from the floodplain, the resulting floodwaters should help to:

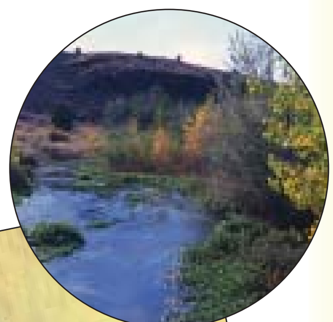
1. Regenerate the dominant riparian trees if seed sources are still present.
2. Decompose accumulated woody debris, reducing fuel loads and aiding nutrient cycling.
3. Create new side channels and wetland habitats as restricted by existing levees.

Such an approach requires storage of sufficient water to simulate a natural spring flood hydrograph as well as the ability to release water at times most advantageous for riparian forest regeneration, which may not coincide with the needs of other users of river water. A successful example of manipulated flooding has been implemented at the Bosque del Apache National Wildlife Refuge in the Middle Rio Grande Valley. Old floodplain areas outside the

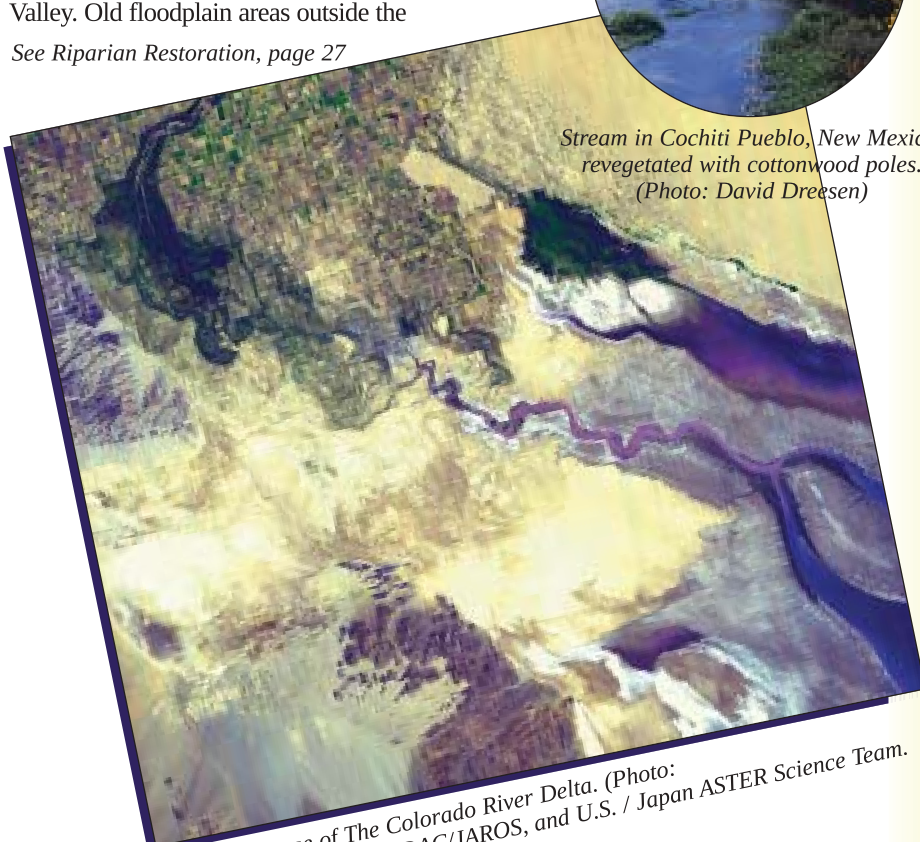
See Riparian Restoration, page 27

Channelized stream without riparian vegetation. (Photo: Apache-Sitgreaves National Forests)

Revegetated stream in Sonoran Desert. (Photo: Apache-Sitgreaves National Forests)



Stream in Cochiti Pueblo, New Mexico, revegetated with cottonwood poles. (Photo: David Dreesen)



Satellite image of The Colorado River Delta. (Photo: NASA/GSFC/MITI/ERSDAC/JAROS, and U.S. / Japan ASTER Science Team.

What Is A Riparian System?

In common speech, riparian typically refers to a vegetation zone adjacent to streams, rivers, lakes or ponds. Often the term riparian-wetland is used to describe these zones because it supports a progression in vegetation types from wetland plants – sedges, rushes and bulrushes – that occupy saturated sediments, to riparian forests that typically experience seasonal flooding but inhabit relatively thick unsaturated alluvium above the water table.

The attributes of a properly functioning riparian system include:

- *A floodplain that is inundated relatively frequently.*
- *A recovering riparian system that exhibits a widening zone of riparian-wetland vegetation.*
- *A channel system with sufficient sinuosity, width/depth ratio, and gradient to dissipate stream energy associated with bankfull flows.*
- *Upland watershed condition sufficient to prevent degradation of the riparian area.*
- *Floodplain and channel characteristics capable of dissipating the energy of high flow events.*
- *A channel system which does not exhibit excessive erosion or deposition.*
- *Channel lowering that occurs at a natural rate.*
- *Lateral movement of the stream channel is associated with natural sinuosity.*

The characteristics of the vegetation in a properly functioning riparian plant community include:

- *An age class distribution indicating the recruitment of young individuals and the maintenance of older individuals.*
- *A diverse species composition comprised of robust and healthy individuals.*
- *Vegetation consistent with the existing soil moisture and water table conditions.*
- *Species with root systems and vegetative cover capable of protecting stream banks from high flow events.*
- *Large woody debris produced that can modify the hydrology of the channel and floodplain in certain types of riparian systems.*

Riparian Restoraton, continued from page 17

levees were cleared of saltcedar and designed to impound water to create soil moisture conditions similar to a natural flood event. This approach successfully re-established cottonwoods and willows on extensive impounded areas (Taylor and McDaniel, 1998).

Other methods of reintroducing trees and shrubs have proved successful on degraded riparian areas that presently do not experience flooding. Planting long-dormant stem cuttings, known as poles, from cottonwood, willow, and other riparian species into augered holes that extend to the water table has allowed the re-establishment of riparian trees on hundreds of acres in the Middle Rio Grande Valley (Dreesen and others, 2002). Containerized plants with very deep root systems have helped establish additional species not suited to pole planting in areas with a fairly shallow water table. These methods are stopgap because the plants will not regenerate unless flooding is eventually reintroduced into the riparian system.

The conflicts between the extraordinary natural resource value of riparian areas and the limited surface water resources in the Southwest will result in future struggles over the allocation of water for the restoration of disturbed riparian areas and for the preservation of pristine riparian areas.

References

Bentrup, G. and J.C. Hoag. 1998. The Practical Streambank Bioengineering Guide. USDA-NRCS Aberdeen Plant Materials Center, Aberdeen, ID. 151 p.

Dreesen, D., J. Harrington, T. Subirge, P. Stewart, and G. Fenchel. 2002. Riparian restoration in the Southwest: species selection, propagation, planting methods, and case studies. In: Dumroese, R.K., L.E. Riley, and T.D. Landis, technical coordinators. National Proceedings: Forest and Conservation Nursery Associations – 1999, 2000, and 2001. Proceedings RMRS-P-24. Ogden, UT: USDA Forest Service, Rocky Mountain Research Station: 253-272.

Prichard, D.J., C. Anderson, J. Correll, J. Fogg, K. Gebhardt, R. Krapf, S. Leonard, B. Mitchell, and J. Staats. 1998. Riparian area management. A user guide to assessing proper functioning condition and supporting science for lotic areas. Technical Reference 1737-15. U.S. Dept. of Interior, Bureau of Land Management, National Applied Resource Sciences Center, P.O. Box 25047, Denver, CO 80225-0047.

Rosgen, D. 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs, CO.

Taylor, J.P. and K.C. McDaniel. 1998. Riparian management on the Bosque del Apache National Wildlife Refuge. New Mexico Journal of Science 38:219-232.